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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,976	01/29/2004	Peng Chang	SAR-14948	4351
28166	7590	02/28/2005	EXAMINER	
MOSER, PATTERSON & SHERIDAN, LLP /SARNOFF CORPORATION 595 SHREWSBURY AVENUE SUITE 100 SHREWSBURY, NJ 07702			LE, BRIAN Q	
			ART UNIT	PAPER NUMBER
			2623	

DATE MAILED: 02/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/766,976

Applicant(s)

CHANG ET AL

Examiner

Brian Q Le

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 13-16 and 20-23 is/are rejected.
- 7) ☒ Claim(s) 8-12, 17-19 and 24-28 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

*Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4, and 8-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Awe Franke et al. Autonomous Driving Goes Downtown. I.E.E.E. Intelligent Systems, 1998, pages: 40-48.

Regarding claim 1, Franke teaches a method of detecting an imminent collision (page 40, column 1) comprising the steps of:

Producing from imagery a depth map of a scene proximate a platform (2D depth map) (page 41, column 3, last 3 lines);

Detecting a potential threat in the depth map (page 42, column 1, and FIG. 4);

Estimating the size of the detected potential threat (object's width) (page 42, column 1, second paragraph);

Estimating the position of the detected potential threat (page 42, column 2, first 5 lines);

Estimating the velocity of the detected potential threat (motion/speed/acceleration estimation) (page 42, column 1 and column 2);

Performing a trajectory analysis of the detected potential threat using the estimated position and the estimated velocity (road recognition) (page 42, column 3, Road Recognition to page 43, column 1); and

Performing a collision prediction based on the trajectory analysis (estimation of relevant

traffic and potential obstacles) (page 41, column 1).

For claim 2, Franke discloses the method further including determining if a collision is imminent based on the collision prediction (obstacle detection) (page 41, column 3, last 3 lines and page 47) and on the estimated size (object's width) (page 42, column 1, second paragraph) of the potential threat.

Referring to claim 3, Franke also teaches a method further including filtering the estimated position and filtering the estimated velocity before performing trajectory analysis (Kalman Filter to estimate motion/speed/acceleration (page 42, column 1 and column 2);

For claim 4, Franke teaches the method wherein the filtering includes Kalman Filtering (page 41, column 3).

Regarding claim 5, Franke further discloses the method wherein estimating the velocity of the detected potential threat includes the step of identifying 2-dimensional feature correspondences from imagery produced in different frames (2D depth map to track cluster of image frame to frame) (page 41, column 3, last 3 lines to page 42, column 1).

For claim 7, Franke teaches the method wherein estimating the velocity of the detected potential threat further includes the step of estimating velocity using Random Sample Consensus (arbitrary data) (page 43, column 1).

Regarding claim 13, please refer back to claims 1 and 2 for the teachings and explanations.

For claim 14, Franke teaches the system wherein said collision detector includes a filter for filtering image noise and outliers from said estimated position and from said estimated velocity before performing trajectory analysis (Kalman Filter) (page 41, column 3).

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Referring to claim 16, Franke teaches the system further including a host vehicle, wherein said stereo camera pair is mounted in fixed locations relative to said host vehicle (page 41, column 2, second paragraph and FIG. 1).

Regarding claim 20, please refer back to claim 1 for the teachings and explanations. In addition, Franke teaches a computer readable medium having stored thereon a plurality of instructions, the plurality of instruction including instructions which, when executed by a processor causes the processor to perform the claimed limitations (computers to run program including instructions) (page 47, column 3).

For claims 21-22, please refer back to claims 3 and 5 for the teachings and explanations.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Awe Franke et al. Autonomous Driving Goes Downtown. I.E.E.E. Intelligent Systems, 1998, pages: 40-48 as applied to claim 1 above, and further in view of Ming Yang et al. Vision-based Real-time Obstacles Detection and Tracking for Autonomous Vehicle Guidance. Real-time Imaging VI, Proceedings of SPIE Vol. 4666, pages 65-74, 2002.

Regarding claim 6, Franke teaches the 3D map of the environment and 2D depth map (page 41, "Stereo-based obstacle detection and tracking", first paragraph) in estimating the velocity of detected of potential threat. However, Franke does not explicitly teach the

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obtaining 3D correspondences from the 2-dimensional feature. Ming teaches a system for obstacles detection and tracking for autonomous vehicle guidance which shows that it is well known to extract 3D information from 2D images for visual guidance (page 65, Introduction, second paragraph). Modifying Franke's method of detecting collision would be able to further provide the flexibility for visual guidance in detecting obstacles. This would improve processing and therefore, it would have been obvious to one of the ordinary skills in the art to modify Franke according to Ming.

Regarding claim 15, please refer back to claims 5 and 6 for the teachings and explanations.

*Allowable Subject Matter*

5. Claims 8-12, 17-19, 24-26, and 27-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*CONCLUSION*

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respect to collision detection:

U.S. Pat. No. 6,151,539 to Bergholz, teaches autonomous vehicle arrangement and method for controlling an autonomous vehicle.

U.S. Pat. No. 6,675,094 to Russell, teaches path prediction system and method.

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U.S. Pat. No. 6,049,756 to Libby, teaches system and method for avoiding collision between vector and solid objects.

Christopher E. Smith. Application of the Controlled Active Vision Framework to Robotic and Transportation Problems. I.E.E.E. 1994, pages 213-220.

Keiji Saneyoshi. Drive Assist System Using Stereo Image Recognition. I.E.E.E. June 1996.

Scott-D-A. Stereo-vision framework for autonomous vehicle guidance and collision avoidance. Proceedings-of-the-SPIE-The-International-Society-for-Optical-Engineering, vol. 5084, p.100-8, 2003.

Ming, Yang. Vision-based Real-time Obstacles Detection and Tracking for Autonomous Vehicle Guidance. Prcoceeding of SPIE Vol. 4666, 2002.

Hiroshi, Koyasu. Realtime Omnidirectional Stereo for Obstacle Detection and Tracking in Dynamic Environments. I.E.E.E. International Conference on Intelligent Robots and Systems, October 2001, pages 31-36.

R. Mandelbaum. Vision for Autonomous Mobility: Image Processing on the VFE-200. I.E.E.E. September, 1998, pages 671-676.

C. Knoepfel. Robust Vehicle Detection at Large Distance Using Low Resolution Cameras. I.E.E.E Intelligent Vehicles Symposion 2000, Pages 267-272.

Uwe Franke. Autonomous Driving Goes Downtown. I.E.E.E Intelligent Systems, 1998, pages 40-48.

Moriy-T. Stereo-based collision avoidance system for urban traffic. SPIE Applications of Digital Image processing July 2002, vol. 4790, pages 417-424.

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7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian Q Le whose telephone number is 703-305-5083. The examiner can normally be reached on 8:30 A.M - 5:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 703-308-6604. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to TC Customer Service whose telephone number is 703-306-0377.

BL  
February 22, 2005



SAMIR AHMED  
PRIMARY EXAMINER